

logging equipment will continue to depress demand for workers. In addition, forest conservation efforts may restrict the volume of public timber available for harvesting, particularly in Federal forests in the West and Northwest, further dampening demand for timber cutting and logging workers.

Little or no change is expected in the employment of forest and conservation workers. Environmental concerns may spur the demand for workers who maintain and conserve our woodlands, especially at the State and local government levels; however, budgetary constraints within the Federal Government and in many State governments are expected to suppress job growth.

Increasing mechanization will have different effects on timber cutting and logging workers. Employment of fallers, buckers, choke setters, and other workers whose jobs are labor intensive should decline, as safer, labor-saving machinery and other equipment are increasingly used. Employment of machinery and equipment operators, such as logging tractor and log handling equipment operators, should be less adversely affected.

Weather can force curtailment of logging operations during the muddy spring season and cold winter months, depending on the geographic region. Changes in the level of construction, particularly residential construction, also affect logging activities in the short term. In addition, logging operations must be relocated when timber harvesting in a particular area has been completed. During prolonged periods of inactivity, some workers may stay on the job to maintain or repair logging machinery and equipment; others are forced to find jobs in other occupations or be without work.

Earnings

Earnings vary depending on the particular forestry or logging occupation and experience, ranging from the minimum wage in some beginning laborer positions to about \$25.00 an hour for some experienced fallers. Median hourly earnings in 1998 for forestry, conservation, and logging occupations were as follows:

All other timber cutting and related logging workers	\$11.65
Fallers and buckers	11.30
Forest and conservation workers	11.13
Logging equipment operators	11.13

Generally, earnings of more skilled workers, such as yarder operators, are higher than those of less skilled workers, such as laborers and choke setters.

Earnings of logging workers vary by size of establishment and by geographic area. Workers in the largest establishments earn more than those in the smallest establishments. Workers in Alaska and the Northwest earn more than those in the South, where the cost of living is generally lower.

In 1999, forestry technicians and aides who worked for the Federal Government averaged about \$31,300 a year.

Forest and conservation workers who work for Federal, State, and local governments and large private firms generally enjoy more generous benefits than workers in smaller firms. Small logging contractors generally offer timber cutting and logging workers few benefits. However, some employers offer full-time workers basic benefits, such as medical coverage, and provide safety apparel and equipment.

Related Occupations

Other occupations concerned with the care of trees and their environment include arborist, groundskeeper, landscaper, nursery worker, and soil conservation technician. Logging equipment operators have skills similar to material moving equipment operators, such as industrial truck and tractor operators and crane and tower operators.

Sources of Additional Information

For information about forestry jobs with the Federal Government, contact:

☛ Chief, U.S. Forest Service, U.S. Department of Agriculture, 14th St. and Independence Ave., SW., Washington, DC 20013.

For information about timber cutting and logging careers and secondary and postsecondary programs offering training for logging occupations, contact:

☛ Northeastern Loggers Association, P.O. Box 69, Old Forge, NY 13420.

☛ Timber Producers Association of Michigan and Wisconsin, P.O. Box 39, Tomahawk, WI 54487.

☛ American Pulpwood Association, Inc., 600 Jefferson Plaza, Suite 350, Rockville, MD 20852.

The school of forestry at your State land-grant college or university should also be able to provide useful information.

A list of State forestry associations and other forestry-related State associations is available at most public libraries.

Inspectors, Testers, and Graders

(O*NET 21911K, 21911M, 21911N, 83002A, 83002B, 83002C, 83002D, 83005A, 83008A, 83008C, 83008D, and 83099)

Significant Points

- For workers who perform relatively simple tests of products, a high school diploma is sufficient; experienced production workers fill more complex precision inspecting positions.
- Like many other occupations concentrated in manufacturing, employment is expected to decline, reflecting the growth of automated inspection and the redistribution of quality control responsibilities from inspectors to other production workers.

Nature of the Work

Inspectors, testers, and graders ensure that your food will not make you sick, your car will run properly, and your pants will not split the first time you wear them. These workers monitor quality standards for virtually all manufactured products, including foods, textiles, clothing, glassware,

motor vehicles, electronic components, computers, and structural steel. As quality has become a more central focus in many production firms, daily duties of inspectors have changed. In some cases, their titles also have changed to "quality control inspector" or a similar name, reflecting the growing importance of quality. (A separate statement on construction and building inspectors appears elsewhere in the *Handbook*.)

Regardless of title, all inspectors, testers, and graders work to guarantee the quality of the goods their firms produce. Specific job duties vary across the wide range of industries in which these workers are found. For example, they may check products by sight, sound, feel, smell, or even taste to locate imperfections, such as cuts, scratches, bubbles, missing pieces, misweaves, or crooked seams. These workers also may verify dimensions, color, weight, texture, strength, or other physical characteristics of objects. Machinery testers generally verify that parts fit, move correctly, and are properly lubricated; check the pressure of gases and the level of liquids; test the flow of electricity; and do a test run to check for proper operation. Some jobs involve only a quick visual inspection; others require a longer, detailed one.

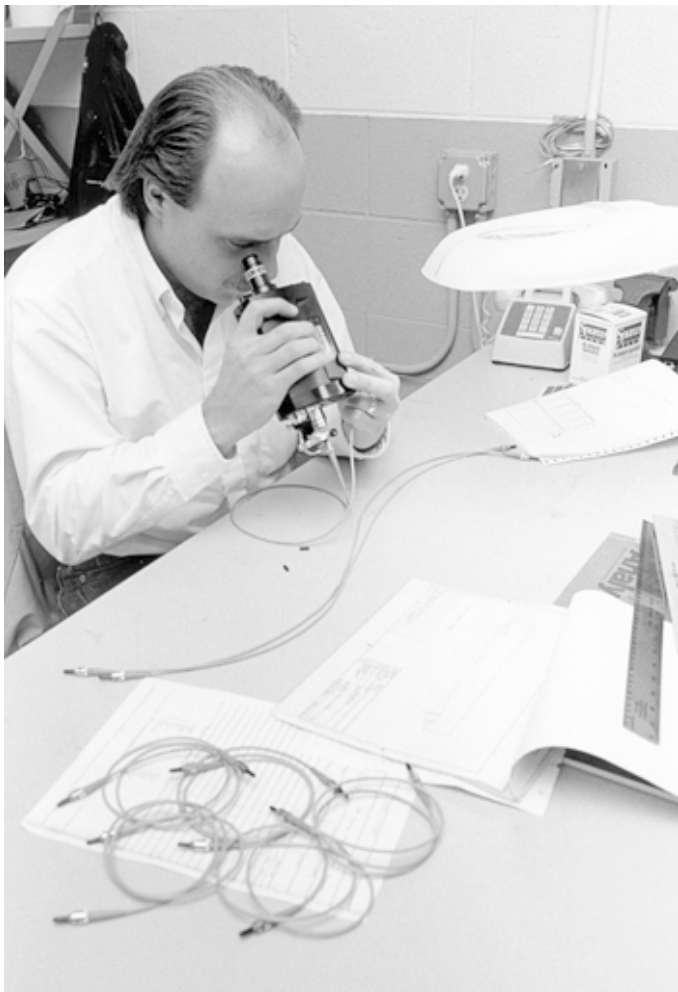
Inspectors, testers, and graders are involved at every stage of the production process. Some inspectors examine materials received from a supplier before sending them to the production line. Others inspect

components, subassemblies, and assemblies or perform a final check on the finished product. Depending on the skill level of the inspectors, they may also set up and test equipment, calibrate precision instruments, or repair defective products.

Inspectors, testers, and graders rely on a number of tools to perform their jobs. Many use micrometers, calipers, alignment gauges, and other instruments to check and compare the dimensions of parts against the parts' specifications. They may also operate electronic equipment, such as measuring machines, which use sensitive probes to measure a part's dimensional accuracy. Inspectors testing electrical devices may use voltmeters, ammeters, and oscilloscopes to test insulation, current flow, and resistance.

Inspectors mark, tag, or note problems. They may reject defective items outright, send them for repair or correction, or fix minor problems themselves. If the product checks out, they may screw on a nameplate, tag it, stamp a serial number, or certify it in some other way. Inspectors, testers, and graders record the results of their inspections, compute the percentage of defects and other statistical parameters, and prepare inspection and test reports. Some electronic inspection equipment automatically provides test reports containing these inspection results. When defects are found, inspectors notify supervisors, and help analyze and correct the production problems.

Recent emphasis on quality control in manufacturing has meant that inspection is becoming more fully integrated into the production process. For example, some companies have set up teams of inspection and production workers to jointly review and improve product quality. In addition, many companies now use self-monitoring production machines to ensure that the output is produced within quality



Inspectors, testers, and graders check products for imperfections.

standards. Self-monitoring machines can alert inspectors to production problems, and automatically repair defects in some cases. Many firms have completely automated inspection with the help of advanced vision systems, using machinery installed at one or several points in the production process. Inspectors in these firms calibrate and monitor the equipment, review output, and perform random product checks.

Working Conditions

Working conditions vary by industry and establishment size. As a result, some inspectors examine similar products for an entire shift, whereas others examine a variety of items. In manufacturing, most inspectors remain at one work station; in transportation, some travel from place to place to do inspections. Inspectors in some industries may be on their feet all day and may have to lift heavy objects, whereas in other industries they sit during most of their shift and do little strenuous work. Workers in heavy manufacturing plants may be exposed to the noise and grime of machinery; in other plants, inspectors work in clean, air-conditioned environments, suitable for carrying out controlled tests.

Some inspectors work evenings, nights, or weekends. In these cases, shift assignments generally are made on the basis of seniority. Overtime may be required to meet production goals.

Employment

Inspectors, testers, and graders held about 689,000 jobs in 1998. About 2 out of 3 worked in manufacturing establishments that produced such products as industrial machinery and equipment, motor vehicles and equipment, aircraft and parts, primary and fabricated metals, electronic components and accessories, food, textiles, and apparel. Inspectors, testers, and graders also were found in temporary help services, transportation, wholesale trade, engineering and management services, and government agencies.

Training, Other Qualifications, and Advancement

Training requirements vary, based on the responsibilities of the inspector, tester, or grader. For workers who perform simple "pass/fail" tests of products, a high school diploma is preferred and may be required for some jobs. Simple jobs may be filled by beginners provided with in-house training. Training for new inspectors may cover the use of special meters, gauges, computers, or other instruments; quality control techniques; blueprint reading; safety; and reporting requirements. There are some postsecondary training programs in testing, but many employers prefer to train inspectors on the job.

Complex precision inspecting positions are filled by experienced assemblers, machine operators, or mechanics who already have a thorough knowledge of the products and production processes. To advance to these positions, experienced workers may need training in statistical process control, new automation, or the company's quality assurance policies. As automated inspection equipment becomes more common, computer skills are increasingly important.

In general, inspectors, testers, and graders need mechanical aptitude, math skills, and good hand-eye coordination and vision. Advancement for these workers frequently takes the form of higher pay. They also may advance to inspector of more complex products, supervisor, or to related positions, such as purchaser of materials and equipment.

Job Outlook

Like many other occupations concentrated in the manufacturing sector, employment of inspectors, testers, and graders is expected to decline through the year 2008. The projected decline stems primarily from the growth of automated inspection and the redistribution of quality control responsibilities from inspectors to production workers. In spite of declining employment, a large number of job openings will arise due to turnover in this large occupation. Many of these jobs, however, will be available only to experienced production workers with advanced skills.

Employment of inspectors, testers, and graders will be significantly affected by the increasing focus on quality in American industry. The

emphasis on quality is leading manufacturers to invest in automated inspection equipment and to take a more systematic approach to quality inspection. Continued improvements in technologies, such as spectrophotometers and computer-assisted visual inspection systems, allow firms to effectively automate simple inspection tasks, increasing worker productivity and reducing the demand for inspectors. As the price of these technologies continues to decrease, they will become more cost-effective for firms and will be more widely implemented in a broad range of industries.

Apart from automation, firms are improving quality by building it into the production process. This has led firms to redistribute many inspection duties from inspectors, testers, and graders to other production workers who monitor quality at every stage of the process. In addition, the growing implementation of statistical process control is resulting in "smarter" inspection. Using this system, firms survey the sources and incidence of defects so these firms can better focus their efforts and reduce production of defective products.

In many industries, however, automation is not being aggressively pursued as an alternative to manual inspection. When key inspection elements are oriented to size, such as length, width, or thickness, automation may play some role in the future. But when taste, smell, texture, appearance, or product performance are important, inspection will probably continue to be done by humans. Employment of inspectors, testers,

and graders is expected to increase in fast-growing industries, such as wholesale trade, and in business services as more manufacturers and industrial firms hire temporary inspectors to increase the flexibility of their staffing strategies.

Earnings

Median hourly earnings of inspectors, testers, and graders were \$11.28 in 1998. The middle 50 percent earned between \$8.63 and \$15.53 an hour. The lowest 10 percent earned less than \$6.78 an hour; the highest 10 percent earned more than \$20.40 an hour. Median hourly earnings of transportation inspectors in the railroad industry were \$18.10 in 1997.

Related Occupations

Workers who inspect products or services include construction and building inspectors, who examine a variety of structures, and inspectors and compliance officers, who inspect and enforce rules on matters such as health, safety, food, licensing, or finance.

Sources of Additional Information

For general information about inspectors, testers, and graders, contact:

- ✦ The National Tooling and Machining Association, 9300 Livingston Rd., Fort Washington, MD 20744. Internet: <http://www.ntma.org>
- ✦ The American Society for Quality, 611 East Wisconsin Ave., P.O. Box 3005, Milwaukee, WI 53201-3005. Internet: <http://www.asq.org>

Metalworking and Plastics-Working Occupations

Jewelers and Precious Stone and Metal Workers

(O*NET 89123A, 89123B, 89126C, 89126E, 89126K, and 89926A)

Significant Points

- About one-third of all jewelers were self-employed; many operated their own store or repair shop, and some specialized in designing and creating custom jewelry.
- Slightly over half of all salaried jewelers worked in retail establishments, while one-third were employed in manufacturing plants.
- Although employment is expected to decline slightly, prospects should be excellent as more people retire or leave the occupation.

Nature of the Work

Jewelers design, manufacture, repair, and adjust rings, necklaces, bracelets, earrings, and other jewelry. They use a variety of common and specialized handtools to mold and shape metal and set gemstones. Increasingly, jewelers use computers to design jewelry and lasers to perform very delicate and intricate work.

Jewelers usually specialize in one or more areas: Designing and manufacturing new pieces of jewelry, gem cutting, setting and polishing stones, or repairing broken items. Jewelers who are knowledgeable about the quality, characteristics, and value of gemstones also sell jewelry and provide appraisal services. In small retail or repair shops, jewelers may be involved in all aspects of the work. Jewelers who own or manage stores or shops also hire and train employees; order, market, and sell merchandise; and perform other managerial duties.

The work of jewelers requires a high degree of skill, precision, and attention to detail regardless of the type of establishment or work setting. Typical repair work includes enlarging or reducing ring sizes,

resetting stones, and replacing broken clasps and mountings. Some jewelers also design or make their own jewelry. Following their own designs, or those created by designers or customers, they begin by shaping the metal or carving wax to make a model for casting the metal. The individual parts are then soldered together, and the jeweler may mount a diamond or other gem, or engrave a design into the metal. Although jewelers mainly use computers for inventory control, some jewelry designers also use them to design and create customized pieces according to their customers' wishes. With the aid of computers, customers visualize different combinations of styles, cuts, shanks, sizes, and stones to create their own pieces.

In manufacturing, jewelers usually specialize in a single operation. Some may make models or tools for the jewelry that is to be produced. Others do finishing work, such as setting stones, polishing, or engraving. A growing number of jewelers use lasers for cutting and improving the quality of stones, intricate engraving or design work, and ID inscription. Some manufacturing firms use CAD/CAM (computer-aided design and manufacturing) to facilitate product design and automate some steps in the mold and model-making process. As such systems become more affordable, their use should increase. In larger manufacturing establishments, jewelers may be required to perform several tasks as new manufacturing processes make their way through the industry.

Working Conditions

A jeweler's work involves a great deal of concentration and attention to detail. Working on precious stones and metals, while trying to satisfy customers' and employers' demands for speed and quality, can cause fatigue or stress. However, the use of more ergonomically correct jewelers' benches has eliminated the strain and discomfort formerly caused by spending long periods bending over a workbench in one position. In larger manufacturing plants and some smaller repair shops, chemicals, sharp or pointed tools, and jewelers' torches pose potential safety threats and may cause injury if proper care is not taken.

In repair shops, jewelers usually work alone with little supervision. In retail stores, on the other hand, they may talk with customers about repairs, perform custom design work, and even do some sales work.